

# ACADEMIC STATEMENT OF PURPOSE

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COMPUTER SCIENCE PH.D. APPLICANT

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Having independent research ability to be able to contribute to the development of society is exactly the reason why I apply for a PhD program. My research interest lies in the area of operating systems and computer networking. Specifically, I am interested in developing a more energy-efficient, reliable and practical systems in these two areas.

For the past two years, I have been conducting research with Professor John Kubiawicz and the Par Lab operating systems group. Specifically, I help design and implement Tessellation, our manycore OS. Experiencing a large-scale systems project, from the early conceptual design stages through implementation and evaluation, has been extremely fruitful, my experiences with the Par Lab have helped in refining my research interests while preparing me for future systems research.

My work in Tessellation began with designing and implementing its Quality of Service (QoS) guarantees in Linux. We needed to implement our own lock-free shared-memory buffer for efficient communications between processes. The framework used for composing the GUI applications that we were targeting is Qt and thus, we modified its internals to encompass the same model as Tessellation. In the end, we were able to earn a 7x speedup in our version of Qt compared to the unmodified Qt. The drastic increase in performance that we achieved is very encouraging since we managed to exercise our engineering skills in a commercial program used by thousands of people. Moreover, the interest expressed by companies such as Nokia when our work is presented at the ParLab 2010 winter retreat [1] has further confirmed our success.

Following that, I was working to complete the existing work in porting Advanced Configuration and Power Interface (ACPI) to Tessellation, collaborating with a post-doctoral researcher from NEC. Understanding the Intel manuals is a challenge in itself since there are hardly any tutorials online. However, by the end of the summer, I'm able to navigate my way through the manuals and even managed to get ACPI running smoothly in Tessellation. When I was porting ACPI, I also restructured how PCI devices are being discovered and added support for PCI-express devices in Tessellation. As our paper deadline is approaching, my focus shifted to implementing and automating the process of running the experiments followed by parsing the results and constructing the graph. My contribution to the project has resulted in a poster presented at HotChips 2011 [3] and two publications submitted to EuroSys and CATA 2012 [2, 4] which are currently in-review.

Additionally, I believe that teaching is an integral part of conducting research. A discovery is far from complete if one does not also find a way to present and elucidate it to others. Even more importantly, organizing a vast array of result for presentation is a crucial skill that a researcher must share with a teacher. I have been involved with education throughout my undergraduate years where I have served as a tutor in the community college and as a teaching assistant for upper division operating systems class in Berkeley.

Affordable and reliable Internet access has been a problem that persists in the developing nations. Growing up in one of the developing countries, Indonesia, I have experienced the impact of

this problem first hand. For instance, thousands of deaths resulted from the Tsunami that struck one of the islands of Indonesia back in 2004. Had there been a properly established networking infrastructure, an early warning system could be designed and thus, this incident could be eluded. This leads to one of the questions that I would like to ponder in graduate school; how to design a more energy-efficient or more reliable network protocol that match the economic capabilities of developing nations. The extent of impact of solutions to this problem does not extend to developing nations only since possessing better network protocol will surely benefit even the most developed countries.

University of Michigan stands out due to the number of world-renowned faculties in the area of systems that I would like to work with such as Professor Morley Mao. There are also many research groups that are closely aligned to my interest such as Mobility Group which focuses on building practical systems solutions to operate in environments with poor connectivity. I am also attracted by the strength of the undergraduate program in University of Michigan as I look forward to teaching as a graduate student. For these reasons, I believe that the PhD program at University of Michigan is the best match for my interest. My long term goal is to remain in the academia as a professor, contributing to the research community, undergraduate education and most importantly, the society as a whole. Given my background, I believe that I am in a good position to make crucial contribution in such pursuits.

## References

- [1] H. Alkaff, V. Chiem, and A. Wang. Preserving Interactivity of GUI Applications. Technical report, UC Berkeley ParLab Retreat, 2010.
- [2] J. A. Colmenares, S. Bird, G. Eads, S. Hofmeyr, E. Huerta-Yero, A. Kim, R. Poddar, H. Alkaff, K. Asanovic, , and J. Kubiawicz. Performance Predictability in the Tessellation Manycore OS. In *Seventh conference on Computer systems (In Review)*, EuroSys, 2012.
- [3] J. A. Colmenares, S. Bird, G. Eads, S. Hofmeyr, E. Huerta-Yero, A. Kim, R. Poddar, H. Alkaff, K. Asanovic, and J. Kubiawicz. Building a Real-time, Responsive, High-throughput Client OS for Many-core Architectures. In *Proceedings of the IEEE Symposium on High Performance Chips*, 2011.
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